

*With the sincere respect
and best thanks of the Author
to Dr Ferguson
for his many
kindnesses*

ON THE
HYPODERMIC ADMINISTRATION

REMEDIES IN NEURALGIA

AND OTHER AFFECTIONS;

BEING A PAPER

READ BEFORE THE ST. GEORGE'S MEDICAL SOCIETY,
ON DECEMBER 9TH, 1858.

BY

CHARLES HUNTER,
LATE HOUSE-SURGEON TO ST. GEORGE'S HOSPITAL.



ALSO A PAPER ON

THE RESPIRATION

THERAPEUTICALLY CONSIDERED IN CERTAIN
CEREBRAL CONDITIONS.

READ AT THE WESTERN MEDICAL SOCIETY, JANUARY 20TH, 1860, AND THE
ST. GEORGE'S MEDICAL SOCIETY, FEBRUARY 2D, 1860.

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ON THE HYPODERMIC ADMINISTRATION OF REMEDIES IN NEURALGIA AND OTHER AFFECTIONS.



MR. PRESIDENT AND GENTLEMEN,—The object of my addressing you this evening is to bring before your notice *a certain mode* of administering medicine, *never before employed*, that I am aware of, in the manner I am about to point out.

To Dr. Alexander Wood, of Edinburgh, is due, I believe, the discovery of the local treatment of neuralgia by narcotic injections; it was to my having tried his treatment in two or three cases, that I was led to employ what I now venture to call the *hypodermic* or subcutaneous cellular treatment.

Medicines, administered to produce either a local or general effect, may be given in various ways—either applied to the skin, to mucous or serous membranes, to wounds, ulcers, or abscesses, or they may be injected into the veins.*

By the skin, medicines, according to our great therapeutical authority, Pereira, may be applied enepidermically, iatroleptically, and endermically.†

Enepidermically to the skin, without friction (for instance, by lotions); iatroleptically to the skin, *with* friction. The objections to these methods are—1st, uncertainty of result; 2d, time required to affect the system; 3d, the frequently unpleasant nature of the process; 4th, local irritation produced by the friction.

The *endermic* method is to the true skin, the derma being denuded generally by a blister. The advantages are that the medicine is submitted pure to the system, and is not submitted to the digestive process; operation by this method is generally quick, and in some cases more rapid than by the stomach. Then there are the disadvantages, such as—1st, pain caused by denuding the derma; 2d, occasional mortification of the part; 3d, the chance of the skin being permanently marked; 4th, some substances will not act by this plan.

Then there is the method by inoculation, proposed by M. Lasargne de St. Emilion to relieve topical pain, morphia being introduced *into* the skin on the point of a lancet!

To the above list I would add the *hypodermic* treatment (the word being derived from $\upsilon\pi\omicron$, under, and $\Delta\epsilon\rho\mu\alpha$, the skin), the phraseo-

* Pereira, vol. i, p. 631.

† 'Association Med. Journal,' August 28, 1858.

logy, if this term be used, corresponding with the other terms of Grecian origin used by Pereira; or it might be called the subcutaneous cellular administration of remedies, for it is by the *loose* cellular tissue immediately beneath the skin that I would employ more generally the introduction of medicines into the system.

This plan has these advantages: 1st, the medicine is introduced into the system uncontaminated; 2d, it is *not* submitted to the digestive process; 3d, its absorption is exceedingly quick; 4th, the disadvantages of the method before mentioned are avoided.

The introduction of morphia on a lancet, practised by M. Lasargne in 1836, appears to have been the first approach to injecting remedies into the cellular tissue, but he went, I believe, no further than the *cutis*. In 1841 M. Valleix published his views on neuralgia, and showed that superficial nerves are chiefly affected, that certain parts of these nerves are affected more than others, and that there are certain tender spots in the course of these nerves, which, if pressed upon, occasion neuralgic paroxysms.

Dr. A. Wood, one day using an aneurismal syringe, thought it just the thing to inject with morphia these tender neuralgic spots indicated by M. Vallieux. Having a patient with neuralgia, he seized the opportunity, and seeking out a tender spot, injected a good dose of morphia, which in a few minutes gave her the look "of a drunken person," and sent her to sleep, and asleep she remained all night, till Dr. Wood, calling the next morning, woke her up—a happier woman, for she had lost her neuralgia.

Dr. Wood's notions are as follow:

1st. That people afflicted with neuralgia (not depending on rheumatism or direct pressure from tumours or nerves) may be cured, or at all events palliated, by narcotic injections.

2d. That these injections act purely locally.

3d. That they should only be had recourse to if a tender spot can be found in the course of the nerve, which, if pressed upon, will occasion a paroxysm of pain.

In vol. i, for 1845, of the 'Abstract,' Mr. Rynd, of Dublin, relates two cases of neuralgia treated by narcotic injection, employed locally, one a case of tic douloureux, the other of sciatica; both were cured. The local treatment was effected in these cases by some undescribed instrument inserted under the skin, and a large amount of morphia was used in each case.

I shall now detail two cases of neuralgia in which I employed the *local* treatment of Dr. Wood.

The first case in which I tried it was that of the man J. Gresham, in the Fuller Ward. The second that of E. Prosser, in the Wright Ward. (The notes of these cases, which were published in the 'Medical Times and Gazette' of October 6th, 1858, were then read.)

Two months ago, then, I was all in favour of Dr. Wood's localization of the remedy, but while the abscesses in these two cases existed, and hindered local injection, I bethought myself of subcutaneous injection of the cellular tissue of adjacent or other parts. I accordingly had recourse to it, and three weeks after I had published the two cases treated by Dr. Wood's plan, I sent the following

observations to the 'Medical Times,' which appeared in the number for October 30th, 1858. (The communication to the 'Medical Times' was then read, the object of which was to show that equal effect followed injections which were *not* employed locally as those that were.)

Since employing the hypodermic method in the above-mentioned cases, I have used it in several others with more striking success. I will briefly give their histories.

CASE 3, for the sake of brevity, is omitted; it will be found, however, as Case 1 in the 'British Medical Journal,' January 8th, 1859.

CASE 4.—Edmund Harrison, æt. 30, was admitted November 2d, under Dr. Page, in the King's Ward, with delirium tremens. An emetic was given on admission, and he was put upon laudanum (fourteen minims) every other hour during the day. From the night of the 2d he did not sleep for two days or nights, and was so excitable that the strait-waistcoat was found necessary. The laudanum having failed, morphia had been given repeatedly, in half-grain doses, by the mouth, but without causing sleep. On November 5th, at three p.m., I injected half a grain of morphia into the cellular tissue of the neck. At the time of the injection he was quiet, but sleepless. Ten minutes after, he was in the same state; eyes open; he was quite quiet. In fifteen minutes the eyes were slightly injected, and were occasionally shut; he was dosing occasionally during the rest of the hour. In two hours he was comfortably asleep, nor did he wake for about six hours. He slept, altogether, about *twelve* hours.

6th.—He was much quieter; morphia injected, same dose, nine p.m. He was sound asleep in three quarters of an hour, and slept *nine* hours.

7th.—Much better; more rational and quiet; injection repeated, with *eight* hours' sleep as the result.

8th.—Delirium fast disappearing; he *slept naturally* in the evening. The narcotic injection was not used nor again required, and he was discharged cured a few days after.

CASE 5.—Mary Jones, æt. 35, of hysterical aspect; was under Dr. Pitman for a short time with pain in the leg and hip, and was then transferred to Mr. Tatum, who regarded the case as subacute inflammation of the hip. Blisters, &c., however, failing to improve her, and there being great absence of sleep, the injection was had recourse to. For nights together this woman never slept (carefully watched, at my request, by the night-nurse), and morphia, in three-quarter-grain doses, produced no effect when given by the stomach. Morphia, however, *injected* into the arm, in three-quarter-grain doses, used to remove the pain and give her good sleep.

Knowing this patient to be *hysterical*, I was tempted one night to inject a few drops of weak tea instead of the morphia, quite unknown to the patient, who after the first night "always expected to sleep much better with the injection." She slept in the night certainly, but not so well as on any of the nights when morphia was employed. "She could not say why she did not sleep so well last night."

CASE 6.—An elderly man was admitted, November 5th, 1858, with a

gunshot wound of the thigh. On the 13th there was delirium, and on the 14th trismus and the other symptoms of tetanus set in.

16th.—The symptoms have gradually increased during the last two days, during which time he has had no good sleep. About twelve p.m. Mr. Tomlinson injected three quarters of a grain of morphia. The man was asleep in twenty-five minutes, and remained asleep for the greater part of the night, totally undisturbed by the spasms, which recurred nearly every minute the whole time he was asleep. From this case we see that, in tetanus, by morphia you may destroy consciousness and produce sleep, and so save your patient many hours' pain from the spasms; and secondly, that although the brain may be brought well under the influence of the narcotic, the spinal system may continue all activity. "The spinal system," says Marshall Hall, "never sleeps."

CASE 7.—In the following case the injection was employed to allay violent excitement of the brain; the man, in fact, was, when admitted, and still is, in a state of *madness*.

I allude to Richard Dunn, at present in the Oxford Ward, admitted on the 1st of December under the care of Mr. Cæsar Hawkins. The man was brought in with a great gash in the throat, the work of his own hands. On the 3d he became, at the hour of midnight, extremely excited, noisy, and restless. The tender aid of David, a policeman, and two half-drachm doses of laudanum, failed to quiet him. I therefore had recourse to the little syringe, and in less than half a minute had introduced three quarters of a grain of morphia in five minims of liquid into the cellular tissue of the man's arm. The result was then watched by Mr. Tomlinson and myself; the man became quiet *directly*, every now and then shutting his eyes, and breathing deeply; in twenty minutes he was asleep, and slept *six hours and a half*. (This man ultimately recovered.)

CASE 8.—James Denson, æt. 70, admitted under Dr. Page, November 24th, King's Ward. Has had gout, and lately suffered day and night from pain in back of the left thigh and leg; is very restless, and does not sleep at night. Ordinary treatment having failed for a fortnight, Dr. Page asked me to try the injection of morphia. I did so, inserting it, not over the sciatic nerve, but in the arm; the man was sound asleep in less than fifteen minutes, he slept all night, and felt quite happy the next day, with no pain in the leg. Half a grain was the quantity employed. It is now three days since the injection was used, during which time he has had good nights, and had little or no pain.

This case shows well the non-necessity of localization, the essence of Dr. Wood's treatment.

CASE 9 is still under treatment; it is that very bad case of chorea now in the Roseberry Ward. Mary Donovan, æt. 16, but hardly looking 12; admitted November 26th, under the care of Dr. Page. On admission, she was suffering from constant, restless, and at times violent, movements of all parts of the body, frightful to look at. She was then, as now, for the most part sleepless, but she is now much weaker, thinner, and more haggard than when admitted. Iron and other remedies have been tried in vain. When I was first

asked to see her it was on the 7th of December ; for three days and nights she had been perpetually on the move, the spasms being at times quite violent, and then, as if from exhaustion, milder ; but she has had *no* sleep during this time. It was to give her sleep that I was asked by Dr. Page to see her ; without sleep she *must* soon have died from sheer exhaustion.

At a quarter to eleven p.m. I injected the one third of a grain of morphia into the lower part of the neck. In fifteen minutes she was fast asleep ; she continued to sleep soundly three quarters of an hour ; she woke suddenly, and was then as violent as before. At half-past two a.m. the next morning, I injected half a grain ; she dozed in two minutes, and slept in four ! nor did she wake for three hours. All yesterday she was still very bad, for it is most difficult to give her food or drink of any sort. One third of a grain of morphia injected yesterday made her quiet and doze for a time ; half a grain injected at half past one a.m. this morning gave her six and a half hours' sleep. It seems to have done her a little good.

And now, quickly to review the cases I have given you, *nine* in number, we see—

First, that *two* were cases of neuralgia ; subcutaneous injection with localization in both cases ; palliation, *but abscess* in both cases. Subsequently hypodermic injection without localization ; equally good effect, *no abscess*.

Secondly, seven cases treated, *not* by Dr. Wood's plan of *local* injection, viz.—sciatica ; object of treatment, removal of pain ; cure resulted in five days.

Delirium tremens, wakefulness, tetanus, mania, and chorea, in all which cases sleep was the object, or alleviation of excitement where it prevailed ; in all the object was gained by the injection, and in all narcotics given by the mouth had been ineffectual.

And now I must refer for a moment to the case of Gresham, with the tic douloureux, in the Fuller Ward. For a long time I despaired of curing him ; the narcotic injection always palliated him, but directly it was left off back came the neuralgia. I do not now, however, give up the idea of sending him out well. By the desire of Dr. Pitman, I have commenced a regular system of narcotization, so to express it, injecting a dose three times a day. I began this on the 17th ult. A fortnight of this treatment has worked marvels ; the man has quite lost all the bad attacks, which before were constant ; he looks a different man, is no longer thin and haggard, and instead of being afraid of opening his mouth, or moving in bed, lest a paroxysm should be excited, he has been up for several days, went in the garden for the first time on the 3d, and is becoming an active man in the ward.

This case has been most instructive ; it shows—

First, that by carefully and constantly keeping up a narcotic influence for a time, you may, in certain cases apparently inveterate, almost, if not altogether, drive away the neuralgia.

Secondly, that the localization of the injection to the painful part, thought by Dr. Wood to be all essential, is altogether unnecessary.

I wish now, Mr. President, to draw your attention to one or two of the important points gained by the hypodermic treatment, and—

First, *the time saved*.—In many diseases everything depends on the speedy introduction of a remedy. To give it by the stomach is the practice, and the result is awaited, the patient being perhaps in an agony of pain for the twenty minutes or half an hour which elapses before the medicine is duly taken up and carried into the blood; but the following instances will show how much quicker this new method acts than do stomachic doses.

1. The man Gresham is constantly asleep in less than two or three minutes when the full dose is injected at ten p.m.

2. The girl Prosser has constantly felt ease almost instantaneously with the injection of the morphia.

3. The excitement of the madman, although great, left immediately the dose was injected.

4. With Mr. Stockwell's aid, I injected one twelfth grain of strychnia into the cellular tissue of a cat; it was tetanic in one minute, and dead in two.

So much for speedy action, and time saved.

Secondly, the following experiments show, not only that time is saved, but that a more powerful effect follows the administration by the cellular tissue than by the stomach.

1. Three quarters of a grain of morphia injected sent Richard Dunn to sleep almost *directly*, and he slept *nearly the whole night*.

2. The same dose by the stomach produced no effect for an hour. Sleep then followed for one hour and a half; he was then restless and excited as before.

3. A rabbit was completely narcotized in five minutes and a half by half a grain of morphia injected; this state lasted for six or seven hours, during which time the animal at times appeared so completely comatose, that Mr. Venning and myself had occasionally to perform artificial respiration. In nine hours the rabbit was quite recovered.

4. Mr. Venning and myself a few days after introduced the same dose of morphia into the stomach of the same rabbit. No effect followed, nor was the morphia brought up.

5. Assisted by Mr. Ash, I injected three quarters of a grain of morphia into the cellular tissue of a cat; in seven minutes it gave a convulsive start; in thirteen minutes the muscles of the body were rigid, and it uttered sharp cries; eighteen minutes, extremities rigid; forty minutes, general tetanus in a most marked degree. Contrary to expectation, the animal recovered. For many hours after the muscular rigidity had passed off the animal appeared in a state of drunkenness. (Same result on other cats. Mr. Batten and other gentlemen present.)

6. The same cat, with the same dose of morphia, but given by the stomach in cold water (Mr. Keal assisting me). Had *no tetanus*. It retched at the end of eight minutes, and was slightly sick; it began the purring (which morphia appears to cause in all cats) in fifteen minutes; at twenty minutes and thirty-five minutes one leg only was convulsed, and in one hour and a half the cat was very excitable, as if tipsy. This lasted several hours, and gradually passed off.

7, 8, and 9. Experiment 6 was repeated, warm water being used instead of cold; the result was as in Experiment 6. Warm water and cold water (Mr. Ash present) were at different times injected by

a catheter into the stomach of the same cat, no morphia being used ; no sickness resulted. When sickness occurred, it was therefore not from mechanical irritation of the stomach, but was the *first effect of the morphia*. From the cases and from the experiments which I have related, I think we may fairly conclude—

1. That medicinal substances, administered by the cellular tissue where it is loose, act with extreme rapidity.
2. That so introduced, they act much more rapidly than when given by the stomach.
3. That they act more effectually than by the stomach and most other methods.
4. That sometimes doses which are inert by the stomach produce most marked and even violent symptoms when injected, which shows that caution must be used, and that smaller injected doses are equivalent to larger stomachic ones.
5. That sometimes stomachic doses not only do no good, but even harm, where the same amount injected is productive of great benefit (Case 2).

We now come to the *modus operandi* of hypodermic injections. I think I have said enough to show that in cases of *neuralgia* localization of the narcotic to the painful part has little or *nothing* to do with the benefit which results. How, then, is the good effected? Dr. Wood does not consider himself bound to answer that question, but he believes that the remedy acts in two ways: first, he says the injection into the cellular tissue in the neighbourhood of the nerve *affects* the nerve; and secondly, “that it acts by being passed into a part which rapidly absorbs the medicine, and sends it through the system, thus producing an almost instantaneous effect.” Dr. Wood still leaves the question open, or rather gives us two modes of action, to both of which he allows some effect, but most to the first, for he says the injection *must* be got into the spot “where you find you can awaken the pain upon pressure.” *Utrum horum mavis accipe*. For my own part I feel inclined to the *second*—to the rapidity of the absorption into the system. I find this quite enough. Two modes are therefore *more* than sufficient. Both the cases and experiments clearly show that rapidity of absorption from the cellular tissue *is sufficient*, let the introduction of the remedy *be where it may*. If I can cure sciatica of the right leg by injecting into the left arm; if I can send a man to sleep in two minutes, whether I inject into his neck or his big toe; or instantly ease neuralgia of the face by injecting into the arm, surely localization *can have nothing to do with it*; the effect *must be general*, and the *great effect* be due to the rapidity of the absorption, and the rapidity of the absorption be due to the *tissue*, and the *nature of the tissue* injected. I say the effect is gained by the rapidity of the absorption, but there is still a question to answer—the medicine being absorbed, where is it carried to to bring about the effect? Is it at once conveyed to the brain and cord, there to act centrically; or is it to the ultimate capillaries of all the vessels of the body, and secondarily *through the nerves* on the brain, &c.? Here is a subject open for discussion.

There appear to me many reasons why the effect of a stomachic dose should not be so great or so rapid as an hypodermic. The medicine by the stomach is given more diluted; it comes into contact with a membrane destined to digest. There is no knowing what the stomach contains, whether it is full or empty, or whether the whole of the medicine introduced into it is absorbed; that which *is* absorbed has to pass by a longer journey to the brain than medicine introduced into the cellular tissue of the body; and lastly, the effect, from what has just been shown, cannot be immediate, but must be culminative.

I have now only to point out the application I would make of this treatment.

Dr. Alexander Wood has for years employed narcotic injections, and with a syringe such as I show you; he is not particular to the tissue he injects, but he *only* employs it in neuralgia, and only in neuralgia when he can *localize*.

On the other hand, I see no necessity to localize; I see reasons why I should not. I would confine the injection to the loose, cellular tissue of the body, and as I have shown the effect of the injections to be *general*, I would propose their employment in a *wider field*.

To Dr. Wood be all respect and honour as the discoverer of this treatment in certain cases of neuralgia, but let me have the credit of showing (if I am correct) that this treatment acts generally, and is applicable in very many cases besides neuralgia.

I would employ it especially in nervous affections, both of the brain and the spinal cord—of the brain in certain cases of nervous irritation, of intense headache and of insomnia, of mania and some other forms of insanity, of delirium tremens and high cerebral excitement; of the cord in chorea, tetanus, and other forms of spinal irritation especially indicating want of rest. In hydrophobia it might perhaps be used. In neuralgia and other painful affections where it appears indicated, although the nerve *cannot be reached*.

In all these affections narcotics or sedatives are the remedies required; of these morphia will be found the most valuable. You may make your own solution of it; it ought to be strong, but be certain of the exact strength. I have tried other narcotics; none answer so well.

There are other than nervous cases in which I hope this method may be found of use; it is, for instance, possible that in some cases of poisoning, or of drunkenness, where the patients cannot or will not swallow, that emesis may be produced, and that immediately, by the injection of antimony.

I now, gentlemen, show you the syringe, which most of you have seen employed in the wards of this hospital; when making use of it, you will find that the best places to inject are the inner parts of the arms and forearms and the lower part of the neck; in these parts the skin is thinner than elsewhere, and the cellular tissue beneath is looser. The quicker the point is inserted the less pain to the patient, or rather the less likely the patient is to feel it, for I have often inserted the nozzle without its being felt. Let the skin be tense where the point is inserted.

In conclusion, I have to testify my sincere thanks to those medical officers, Dr. Page and Dr. Pitman, and to those surgeons, Mr. Hawkins and Mr. Tatum, who have so kindly given me the opportunities which I have had of trying this treatment.*

THE RESPIRATION THERAPEUTICALLY CONSIDERED IN CERTAIN CEREBRAL CONDITIONS.

MR. PRESIDENT AND GENTLEMEN,—We have all of us, I have no doubt, noticed that when our attention happens to have been drawn (say accidentally) to a subject, and we begin to consider it, why the more we look at it, the more important it seems to us to grow; it assumes new phases, it suggests new and independent ideas, perhaps sound and rational, perhaps high flown and chimerical, which ideas, good or bad, would never have come into our heads, but for mere *chance*, as it is called, having thrown the matter in our way.

* * * * *

So with regard to the subject of this paper. To my having been one of those who worked out for the late Dr. Marshall Hall, the problem of postural respiration in the dead-house of this hospital, am I indebted for my thoughts being directed to the respiration in disease.†

The state of the respiration (too often neglected) is highly important in many points of view—for diagnosis, for prognosis, and for treatment, not only as regards the lungs themselves, or disease in and affecting the lungs, but valuable also in *certain conditions* of the *brain* (including the medulla oblongata).

I would arrange these conditions thus :

1. Functional cerebral derangements, such as headache, cerebral plethora, lethargy, stupor, &c.
2. Epilepsy.

* Both the cases and the experiments were given in detail, but are here condensed as much as possible.

† Mr. Bowles, travelling from the same point, has particularly studied *stertor*.

3. Coma from injury or disease, sanguineous or serous.

4. Cerebral narcotism.

We shall chiefly consider the above-mentioned conditions, under two heads :

1. Whether, in the functional cerebral derangements (epilepsy included), there is not a deficiency of normal respiration ; and whether *that deficiency* is the cause or effect of the cerebral functional derangement.

2. Whether, in the more emergent cases of coma or narcotism (be they from accident or disease), we do not learn more from the state of the respiration than from anything else, not only as regards diagnosis, as to the site of the effusion ; or prognosis—for it will be allowed, I think, that the more the respiration is affected in these cases the more likely the result is to be fatal—but especially as regards treatment ; for the freer respiration is or can be rendered, the further the patient is or can be carried from impending (at all events from speedy) death.

In these cerebral conditions, therefore, we must carefully observe the rate, volume, freedom or not from obstruction, &c., of the respiration ; and, in both the more and less urgent cases, the most effectual mode of establishing free respiration must be our object.

Now the brain and the lungs may *each* be the seat of a certain condition, which condition may manifest itself by symptoms, especially affecting the *other* ; thus, there may be deficient respiration from lung imperfection, *inducing* marked cerebral symptoms ; to remove the cerebral symptoms the lungs must be treated.

Reversing the order, certain cerebral states may induce serious lung symptoms ; treating the brain may remove the lung symptoms, but aid may be called in too late to do so effectually ; in which case, the only chance remaining is to treat the lungs, which are secondarily affected, or the patient may be lost.

If this is the case, we can do more by treating the lungs than by treating the brain ; for we can the better see their condition, whether it be the cause or effect of the state of the brain.

The connection between the brain and the lungs is strictly anatomical, and far greater than between the brain and the heart.

The *heart* has an action of its own, regulated by its own nervous ganglia ; having these to guide it, it is independent of either brain or chord, and will act for hours after they are dead.

But neither can the brain do without the lungs, nor the lungs without the brain ; *insensibility* is induced directly respiration is arrested ; the lungs cease to act the moment the base of the brain is destroyed. Pathologically, coma is comparatively harmless while the respiration is slightly impaired, fatal if greatly so ; the patient whose respiration is suddenly stopped will die *insensible*, or in epileptic fits.

To begin with the effects of cerebral injuries and sanguineous apoplexy upon the respiration :—

Theoretically, the more superficial the injury to the brain is, or the further the apoplectic clot is *from* the medulla oblongata, the better for the patient, and the less the respiration is likely to be affected ; practically it is generally so.

A case was then given (June 3d, 1856) of extensive injury to the vault of the skull, fracture with great depression, but no affection of the respiration, and no bad symptoms at all.

This case simply shows that, great as was the injury, no harm resulted, for the respiratory tract remained unaffected.

CASE 2.—(This was given in detail, it will be found as “Case 2, page 608, ‘Lancet,’ June 18th, 1859.)

This case is of physiological interest. The man suffered at first from shock and consequent insensibility, but this insensibility occasioned neither *deep* nor laboured respiration, for this reason, that the heart participated in the effects of the shock: the heart, however, got over *its* shock, coma came on, difficult respiration, and suffocation, the man died because the coma so materially affected the respiration. The preopnœa added *eight* hours to the vital existence of this man, the nature of the apnœa I shall remark on after the next case; but I would here ask whether, in those cases where blood is effused within the skull, the lateral position is *not* preferable to the supine on gravitating principles?

CASE 3.—On October 13th, 1859, a coachman was found insensible in his bed, having come in from driving a short time before. Half an hour, at the furthest, from the time he might have been seized with the fit, he was black in the face, thoroughly insensible in the supine position, and appeared likely every minute to *choke*, from the quantity of fluid in the lungs and bronchial tubes; frothy mucus seemed to fill both the nares and mouth.

The necessity for an alteration in the position from supine to prone, was the obvious and immediate indication, and the first thing to be adopted—for the man was evidently dying from suffocation, and beyond the reach of all other measures. Ten, a.m.—After this alteration in posture, the respiration had remarkably improved—it was noisy, not from muscular paralysis, but from mechanical obstruction in the tubes—no stertor, face dusky, head hot, total insensibility, pupils closely contracted, pulse full, 96. A pool of sanguineous and frothy expectoration had collected on the bed since the adoption of the prone position. After a short time the breathing became still freer, and even assisted by exaggerated muscular efforts (query—instinctive or semi-conscious?) at such times when more obstruction seemed to exist in the tubes.

The ordinary remedies were not neglected, bleeding, sinapisms, &c., being employed. Life continued four hours, when the patient quietly died *the death of narcotism*.

The chief interesting points in this case of apoplexy are: that it was a first attack, *nearly fatal in less than an hour—fatal in four*. There was no paralysis; almost up to the last, the hands rigidly grasped anything put into them. The body now and then turned about, even forced expiration occasionally took place; but while the spinal system still acted, and was evidently excited at times, the brain (the sensorial ganglia and sensory nerves) appeared thoroughly insensible; but the state of the lungs and the absence of blood aeration were the most prominent features—the post-mortem explained the reason why.

There was no blood effused in the brain proper, but an immense clot of thick black blood in the medulla oblongata itself, breaking up its texture; and at one part the wall of the fourth ventricle, which consequently contained some clotted blood, the presence of which had driven the normal fluid of the cavity tinged with blood into the other ventricles. This accounted for the rapid *apnœal* death, and for the body becoming colder and paler than the state of the heart was sufficient to explain; and for the very thick state of the blood, which would hardly flow from a large vein.

The question is now to determine what the kind of apnœa was which was induced in the *two* preceding cases, for the term apnœa (olim asphyxia) is usually employed to signify a state consequent on cessation of respiratory (muscular) action; this point, the kind of apnœa, has not received, as yet, the attention it deserves; for it affects treatment.

There is, in my opinion, a difference between cessation of lung action and respiratory, which is muscular, action. In neither of the cases just given was the death from cessation of respiratory *action*. In both, you will recollect, the respiratory efforts *went on*, and in the last case, although the medulla oblongata was nearly destroyed, even *forced* expiration now and then took place.

The apnœa had a different cause; it was in both cases, from what appeared like complete relaxation of the pulmonary tissue (*paralysis* allowing exudation but *no* absorption), and so great was the mucous development in Case 2 (cerebral injury), that directly prenopnœa was adopted, "a large quantity of frothy mucus rolled from the mouth with each expiration."

But in the third case there was more than mucus, and that in less than an hour; there blood and mucus were poured out with the facility and rapidity that mucus alone was in the preceding case. I look on the pouring out of the blood with the mucus as indicative of the suddenness of, and the amount of the deprivation of nervous influence; just as in sudden cases of spinal paralysis, the urine, is one day clear, and the next full of blood and offensive.

Extreme as these two cases were, life was prolonged in both by attention to the respiration. Surely this is encouragement for us not to neglect careful observation of the lungs in similar cases. Life may be the happy result.

In this class of cases, it is not artificial respiration which is indicated, but *prenopnœa*—for the apnœa is from effusion, not from musculo-respiratory paralysis.

The prenopnœa is trebly useful.

- 1stly. Prophylactically to *prevent* (when employed early) the accumulation in the tubes.
- 2dly. To remove the fluid in the bronchia, if it has been allowed to collect; and in either case,
- 3dly. To prevent the secondary effect of narcotism, by carbonic acid being added to coma from compression, which must take place if the lungs are allowed to fill with fluid.

In the slighter forms of apoplexy, the respiration is also affected, although none of the urgent symptoms which occurred in the cases described may manifest themselves.

In cerebral hemiplegia, loss of motion in the mouth, arm, and leg attract attention; whilst the respiratory muscles of the paralysed seldom do, although they are more or less affected. There is, therefore, a greater or less tendency for the lung to congest; and if the muscles do not soon recover their power, the lung of the paralysed side by the persistence of congestion and muscular inaction, obtains a tendency to *consolidation*.

There is a patient now (January 14) in this hospital with hemiplegia of the left side; the left lung has mucous râles wherever listened to, which did not exist two days ago; nor does air enter by free muscular action, but by a kind of *puff* or blow; whilst on the unparalysed side, air freely enters and proceeds from the lung.

A patient now under my care had an hemiplegic attack of the right side two years ago. Neither the arm nor leg have yet quite recovered their power. The right lung seems of no service to the patient, for there is no breathing to be heard in it by auscultation, whilst the cardiac pulsations resound all over it; the other lung, however, acts well. There is consequently deficiency of due blood aeration, which *tells on* the brain; her face is sallow, her eyes look heavy, she has a most lethargic tendency, generally feels sleepy while walking about, and drops asleep if she sits down; sleeps soundly at night; her walk is like that of a person half asleep, or slightly tipsy, so that she seldom cares to go out in the fresh air, which would be one of the best things for her.

There are many other states of the brain where the respiration becomes remarkably embarrassed, sometimes dangerously so. What the states are which *cause* these symptoms, I will not pretend to say: the temporary presence of serous effusion is, perhaps, one of the chief; but we can see and judge of the *effect*, and do our best to ward off danger.

One such case is that of a dispensary patient, who had a paralytic stroke five years ago. He is still subject to various symptoms dependent on cerebral lesion; at one time excessive sickness, at another loss of muscular power. Not long ago he had great congestion of the lungs, and effusion into the bronchia; but these conditions have now subsided.

Another instance I might bring forward is that of an elderly gentleman, *bon vivant*, plethoric, slightly corpulent; he had a paralytic stroke five years ago; his heart and lungs are, in Dr. Billing's opinion, free from any organic disease. His urine I find quite healthy. This patient has of late been seized at times with sudden cessation of lung action, just as if the nervous supply of the lungs was *withdrawn*. The dyspnœa on these occasions is great, and apnœa sometimes seems to threaten; there is at these times a great tendency to (and at the same time a dread of) sleep. This state of lungs seems to be only *one* of certain cerebral symptoms which this patient has been subject to since the paralytic *stroke*. The power of attention being sometimes lost, memory also; sleep coming on at odd times, &c., as if the cerebrum was influenced, just as the medulla is when the *respiration* becomes impaired.

Again, there may be serous effusion on the brain, where the kid-

neys are diseased; and in such cases the power to respire may suddenly be lost, and the lungs fill with fluid (congestion and bronchial effusion), and that so rapidly and to so great an extent that death by apnœa results. In a case of this kind, where the lungs had ceased acting, and the heart secondarily to them, I had the good fortune, whilst house-surgeon to this hospital, to restore the patient, after several hours' careful attention to the respiration and to position. ('Lancet,' June 18, 1859.)

To pass now to the *respiration in narcotism*.

In proportion to the amount of narcotism, whether purposely or accidentally induced, the respiration, like the brain, is influenced; the deeper the narcotic coma, the more the respiration should be watched.

It may be said, perhaps, that there is no difference between the coma of narcotism and *its* effect on the respiration, and the coma of cerebral compression and *its* effect on the breathing; but there is a difference, which is physiological and affects treatment.

In coma from cerebral compression, the *heart's action* is unaffected, a full pulse of 80 or 90 is often found: but in narcotism the heart is materially affected.

Three quarters of a grain of morphia hypodermically employed in a case of mania lowered the pulse, in *two minutes*, from 120 to 100; and, in *two minutes more*, from 100 to 80, at which the pulse ceased to diminish.

From careful observations on a rabbit, that I kept under the influence of chloroform for one hour and a half, I found that with each fresh application of chloroform, the number of cardiac pulsations diminished, sometimes to half the ordinary number.

(For Observations on the Respiration, see 'Medical Times and Gazette,' November 6, 1858.) Other examples were given from pathology, from experiment, and from medicinal administration. Thus we find that in narcotism there is diminished heart's action, which there is not in coma. The importance of attention to the state of the heart will be seen in a minute.

With regard to the lungs there is a great difference between narcotic and apoplectic apnœa.

In the latter there is, in well-marked cases, rapid and extreme congestion of the lungs, which appear thoroughly paralysed, though the muscles which move them are not; there is superabundant secretion poured out, sometimes to an enormous amount, and sometimes mixed with blood; but in narcotic apnœa, the secretion just alluded to does not take place, however profound the narcotic sleep may be; congestion occurs, but it is not so great nor so rapid as in apoplectic coma.

In apoplectic coma the congestion is *one stage*, consequent on two causes, deficient lung action and non-diminished cardiac action.

The bronchial effusion is a *second stage*, consequent on the congestion, and in proportion to its amount and rapidity of formation.

In narcotic apnœa, the *second stage* is seldom, if ever, reached; the first may be, for the heart's action, although quickly lowered by the

first effect of a narcotic, does not continue to diminish in the same ratio as the respiration does.

Another difference in the kind of apnoea is, that in narcotic apnoea the failure of musculo-respiratory action is the great thing to dread—it may be the sole cause of death.

The *points in the treatment* that I would draw attention to, would, if these views are correct, be—

That, in the apoplectic apnoea, prenopnoea is especially important, for the reasons previously given; venesection is important as a means of removing, and preventing the furtherance of, congestion; artificial respiration is not a necessity.

That, in narcotic apnoea, there is not the necessity for venesection that there is in apoplectic apnoea; nor is prone respiration required for the removal of bronchial effusion; but it is especially indicated for a different reason, viz., lingual paralysis. Artificial respiration, not always necessary in apoplexy, may here be invaluable; for the respiratory muscles, like the tongue, are apt to be paralysed; if, however, artificial respiration be employed, without attention to the tongue—without either drawing forward the tongue with forceps, or adopting the prone position (Hall), that it may leave the glottis free; if, I say, one or other of these measures *be not adopted*, you may attempt artificial respiration in vain.

Thirdly, let us consider the respiration in epilepsy. Epilepsy is a functional affection of the brain, not often connected with organic disease thereof; its nature a state of preternatural excitability, which, carried to excess, ends in the epileptic seizure.

Such you will allow me to consider epilepsy, generally speaking. The points to which I would draw your attention I will put interrogatively.

1. Is the absence of free respiration ever a predisposing or exciting cause of epilepsy?

2. If so, how does the deficiency of normal respiration act so as to cause epilepsy?

3. Does the epileptic seizure affect the respiration?

4. Can the respiration (or attention to it) be employed therapeutically in epilepsy?

My answers to these questions are—

1. I believe that a deficiency of normal respiration may be, and often is, a predisposing cause of epilepsy.

2. That mechanically or suddenly obstructed respiration not only may be, but decidedly is, an exciting cause of epileptic seizures.

3. That in both these cases, the absence of normal respiration causes the epileptic tendency or seizure by occasioning carbonic acid to circulate through the brain; and also by impeding free venous return from the brain.

4. That the epileptic seizure does, in its turn, affect the respiration; the impediment to the respiration is, in fact, *the* most important symptom the seizure presents.

5. I believe the respiration can be employed as a therapeutic agent in epilepsy.

It may be stated as an undoubted fact that mechanical obstruction

of the respiration will excite epileptic seizures : the half-drowned man will have *fits* as he comes to ; the executioner's victim will die in fits ; the patient whose lungs are nearly destroyed by phthisis, will have epileptic fits, who never had them before—but the cause of the fits in all these cases is differently assigned by different physiologists ; for my own part, I look on the circulation of carbonic acid, as the exciting cause of the epilepsy in all these states ; continuation of circulation ; without blood aeration, helps to kill the individual by carbonic acid narcotism, and consequent epilepsy. Supply him well with fresh air, neutralise the carbonic acid, and he will do well.

Then, with regard to a generally existing deficiency of respiration, acting as a predisposing cause of epilepsy. This is a view of my own, founded on a mixture of fact and theory. The fact part is this, that of certain epileptics that are now and have been under my care, two or three of them have extremely shallow chests. The amount of respiration in these patients is much below the average. Two, in particular, I may mention, both of them men ; one has had epilepsy all his life, the other for five years. In both, the number of respirations is less than one to four cardiac pulsations, (about two to nine) and very feeble in character ; during inspiration, air seems hardly to enter their lungs—the respiratory acts can hardly be heard with the stethoscope, so little do their chests expand. They both find difficulty and pain in drawing a deep breath, which is bad, especially for epileptics ; as I believe with Dr. Wardrop that the lungs are great cerebral diverticula, and are therefore highly useful to all for relieving the brain of temporary congestion, especially therefore to be desired free and healthy in epileptics.

Theoretically, I feel disposed to think that these shallow-chested epileptics labour under a two-fold evil ; the first, that the lungs are acting less freely and less often, than they ought to do—they *cannot* therefore sufficiently oxydise the blood. The second is, that as they cannot freely expand the chest, they have no free vent for venous blood from the brain, they have therefore a tendency to congestion of the brain, and to a fulness of its veins ; couple this prevention of exit of venous blood with the introduction of carbonized blood into the brain itself, and I think a sufficient cause of epilepsy is found, for many of those “obscure cases” for which (if this is not the cause) none other can be assigned.

As confirmatory evidence, let it be recollected that the inhalation of carbonic acid gas is a known excitant of epileptic convulsions ; that many epileptic patients have a very sallow or very pale complexion, which shows that blood oxydation is not perfect ; also that these patients have a great tendency to sleep, and to headache, both which are symptomatic of carbonic acid in the blood ; and lastly, that the seizures more frequently occur at night, (at least in many cases) at which time respiration is slower and less effectual, as a blood oxydizer, than during the day, when it is stimulated to greater activity by exercise, &c. I am the more inclined to regard deficient respiration (whether from a contracted chest or otherwise) as a cause of epilepsy, and that far more frequently than is usually thought (not that I have ever yet heard that a shallow or feebly-acting chest has been assigned

a cause of epilepsy by others), from certain observations and experiments I have lately been making with regard to sleep, which was the subject I had meant to bring before you this evening; but I will here only say that I think the conditions which predispose to epilepsy are generally those which predispose to sleep: they may be summed up as all those which tend to arrest respiratory action, and blood oxydation, without diminishing the circulation in proportion. A prolonged hot bath will sometimes have this effect.

I will conclude, gentlemen, with the following summary:

1. That attention to the lungs is of vital importance in certain states of the brain. The respiration may therefore be employed, not only symptomatically, but also *therapeutically* in these conditions.

2. That in coma from compression, death is generally from the lungs, from pulmo-bronchial effusion, (muscular paralysis being sometimes secondarily added,) life may be prolonged or saved by attention to the respiration, by prenopnœa.

3. That in coma from narcotism, death is generally from muscular paralysis; attention to the paralysed parts, the tongue, and respiratory muscles, may save life by the prone position and artificial respiration.

4. That in cases of extreme dyspnœa, from effusion into or upon the brain, life may be endangered from apnœa; the employment of cool fresh air, æther, and ammonia, *may* suffice; they may not, and artificial respiration is then required.

5. Epilepsy may be induced by absence of free respiration; the indications are to employ moderate exercise, cold sponging in the morning, a walk at least once a day, the avoidance of close rooms, &c.

Epilepsy may cause death by apnœa; where this threatens, treatment must be active, prone position, artificial respiration, perhaps tracheotomy.

6thly, for the cerebral derangements, such as headache, excessive lethargy, &c., these are often to be looked on as dependent on carbonic acid in the blood, or due to congestion of the cerebral veins; take for instance, the theatre-headache; for such, a few deep inspirations of cool fresh air may be the only treatment required.

